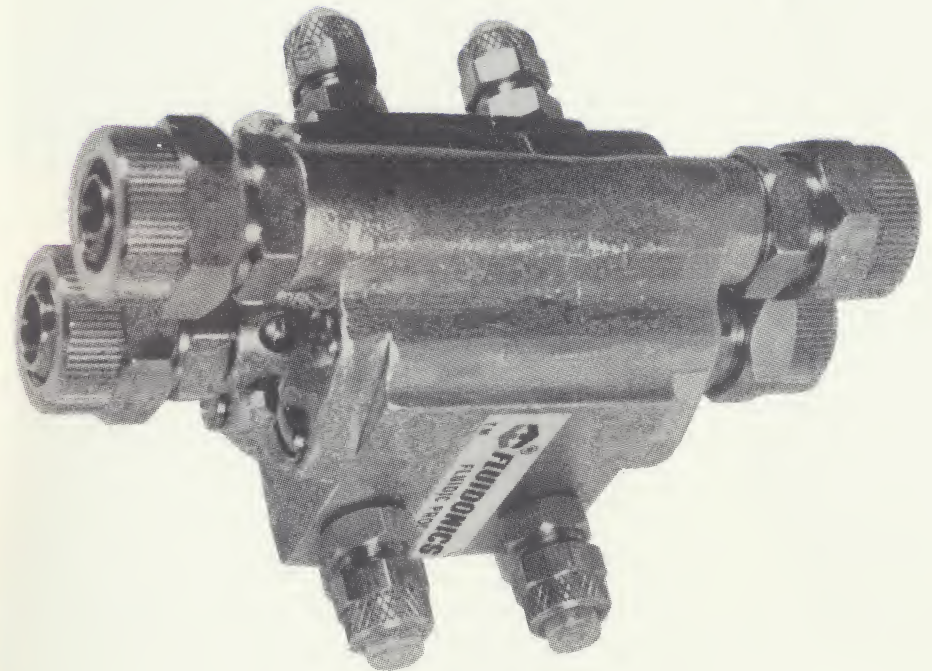




FLUIDONICS®

DIVISION OF IMPERIAL-EASTMAN CORP.
6300 W. HOWARD ST., CHICAGO, ILL. 60648

FLUIDONICS



FLUIDIC VORTEX AMPLIFIER

Now Flow Control With A No-Moving Parts
Fluidic Amplifier!

FLUIDONICS VORTEX AMPLIFIERS

The Vortex Amplifier is essentially a variable restrictor which achieves resistance to flow by a means of a constrained vortex. In addition to modulating flow, a Vortex Amplifier can also modulate power. Vortex Amplifiers control the flow of both liquids and gases.

Some promising areas of application for flow control are chemical processing, oil refining, food processing, natural gas systems, engine fuel control and boiler control. Vortex power amplifiers can be used in hydraulic and pneumatic systems as power stages for driving cylinders and motors. They can also be used for piloting conventional control valves. They have the potential for being applied in all types and varieties of fuel power systems.

The double chamber vented Vortex Amplifier shown that is now ready for test marketing has the characteristics of a servo valve. It differs from conventional servo valves in that the input signal is fluidic rather than electrical, but the net result is the same. Because of no moving parts, the frequency response of the fluidic servo valve is very high: in the vicinity of 50 - 75 cps. An additional advantage of this system over conventional servo valves is a relative insensitivity to contamination. This becomes obvious when one considers the large flow passages used in fluidic devices and the extremely small clearances characteristics of spool valves.

Types Available

There are four types of Fluidonics Vortex Amplifiers (three sizes each) available for test marketing at this moment. They are: the single chamber vented, the single chamber non-vented, the double chamber vented, and the double chamber non-vented. Shown is a complete list of types and sizes.

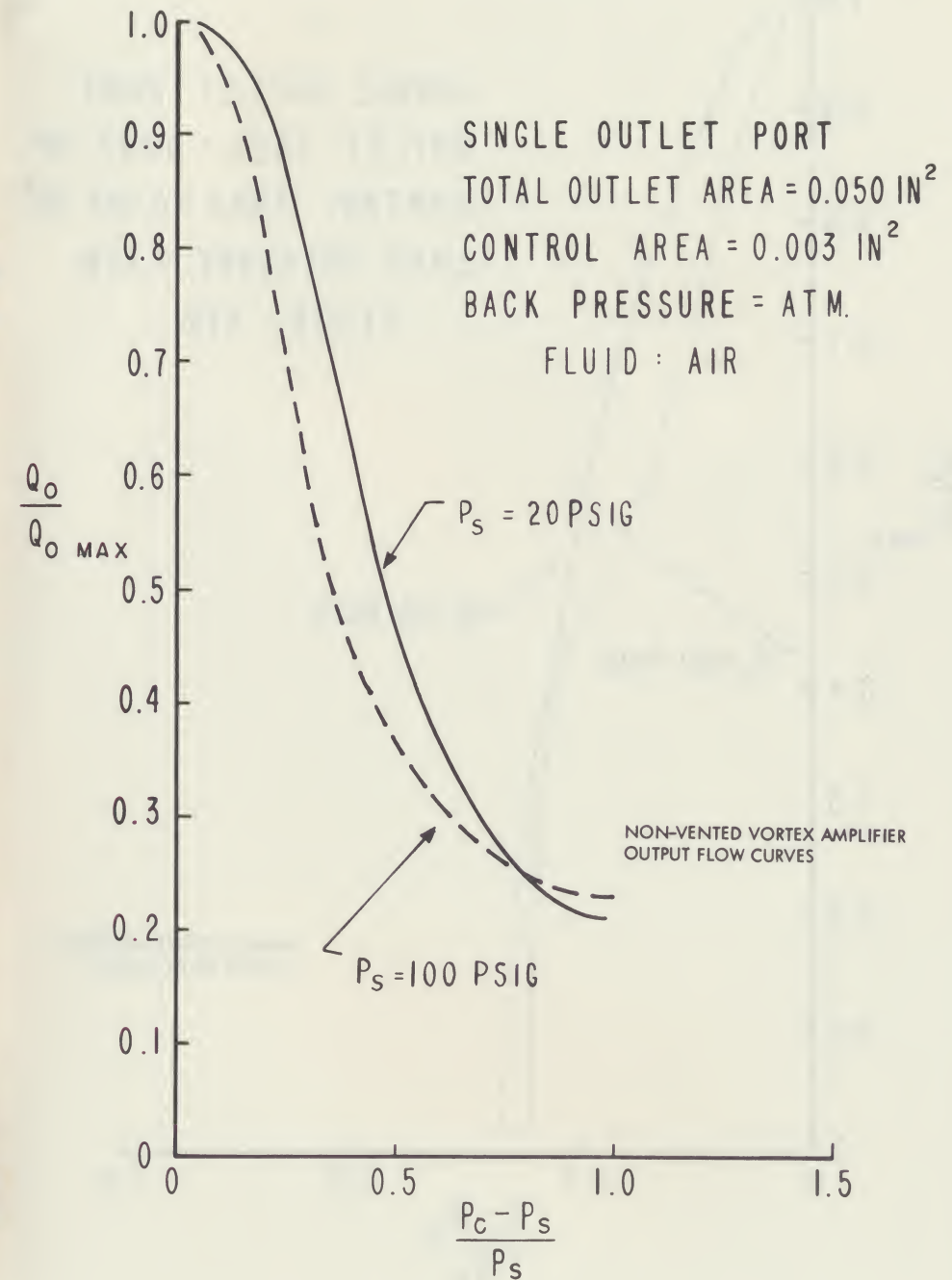
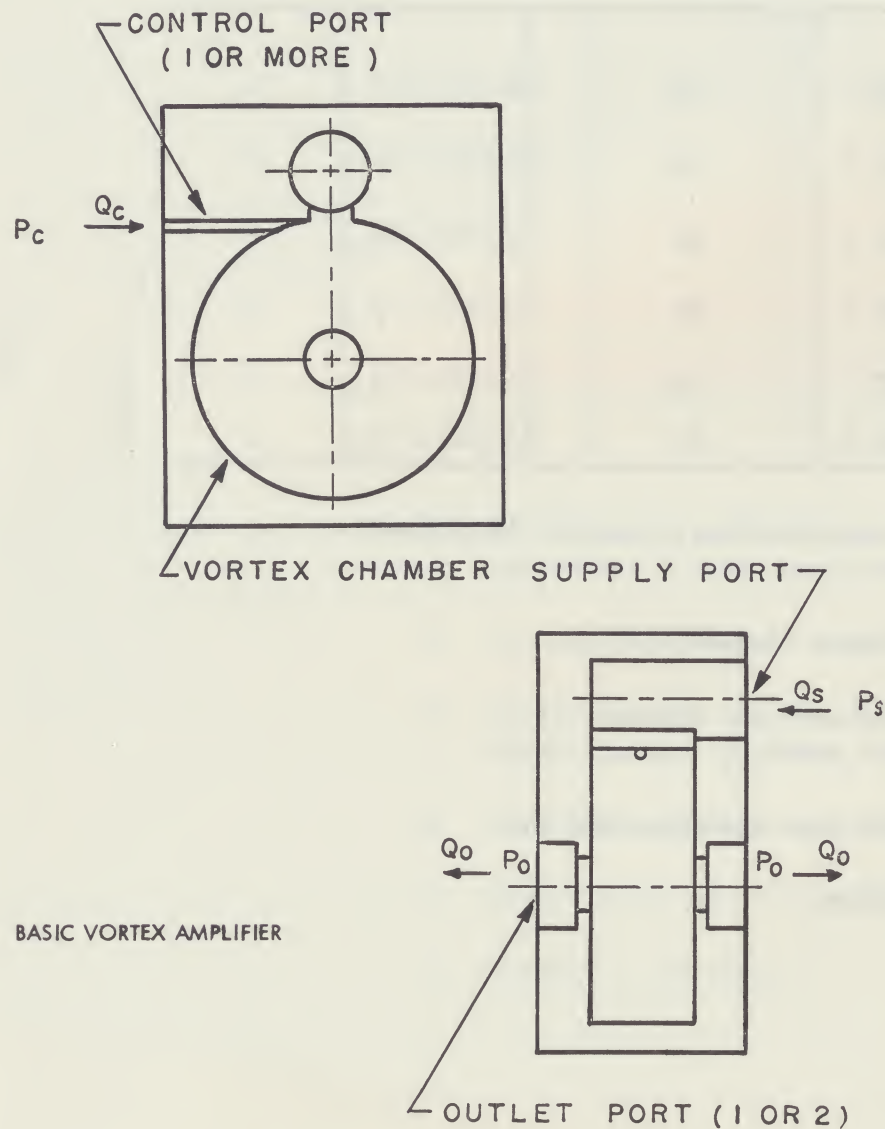
FLUIDONICS VORTEX AMPLIFIER SIZES

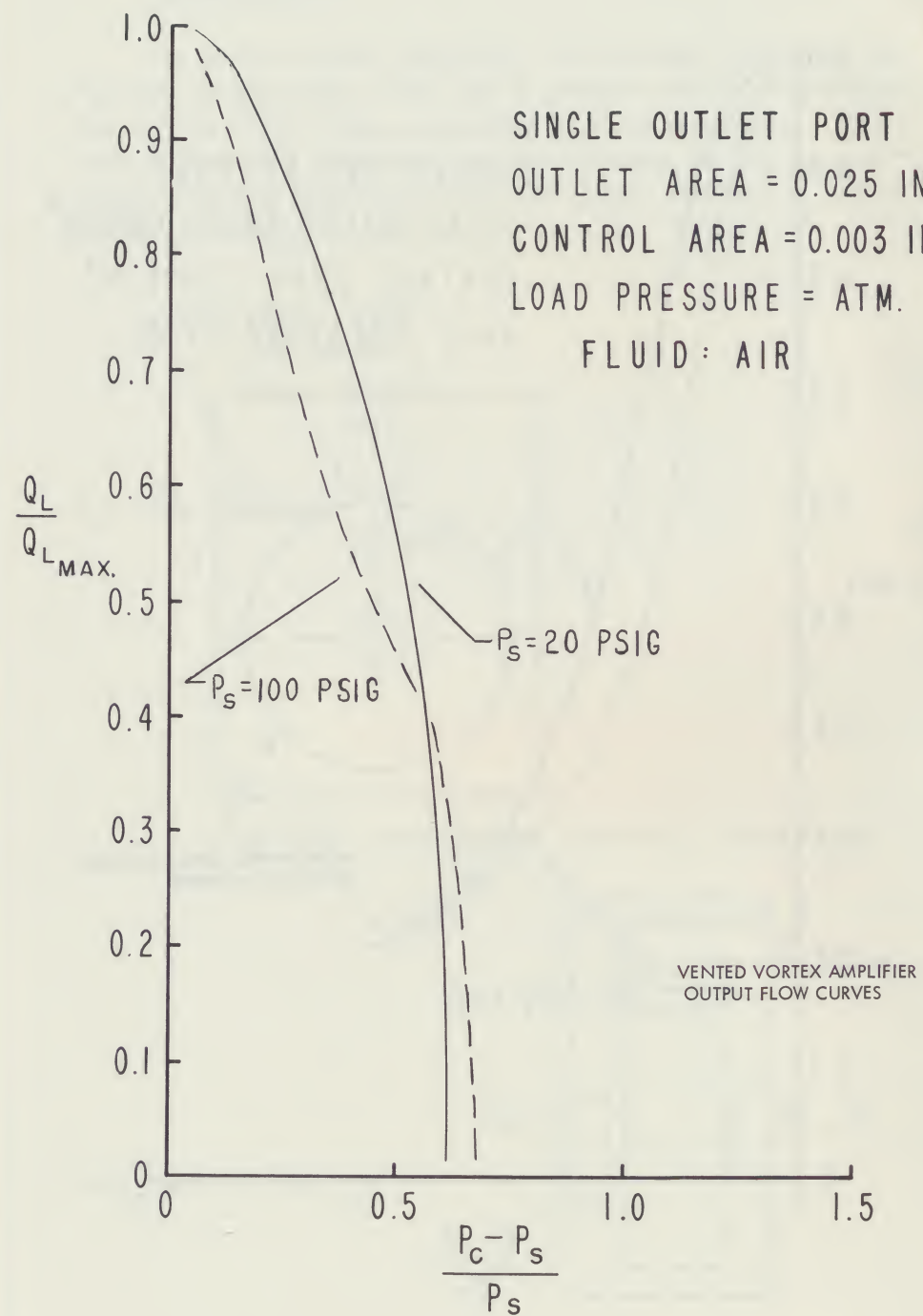
Model Size	Amplifier Identification	Number of Vortex Chambers	Outlet Orifice Diameter Inches	C _v of Outlet Port	Max. Output Flow At 50 psig supply, scfm	Max. Output Power at 50 psig Supply (vented) h.p.
4	FV-1100-4A	2	0.125	0.45	14	1.3
4	FV-1000-4A	1	0.125	0.45	14	1.3
5	FV-1100-5A	2	0.180	0.90	28	2.6
5	FV-1000-5A	1	0.180	0.90	28	2.6
6	FV-1100-6A	2	0.250	1.80	56	5.2
6	FV-1000-6A	1	0.250	1.80	56	5.2

1. All above are available vented or non-vented making a total of 12 different types/sizes to meet specific requirements.
2. All amplifiers have 3 control ports per vortex chamber.
3. Double chamber amplifiers have one outlet port per chamber. Single chamber amplifiers have two outlet ports.
4. Performance data given is for single outlet port operation with air.
5. Control ports are 1/16 inch diameter orifices.
6. Material is aluminum.

Control Inputs

As in all Vortex Amplifiers, the control fluid must be the same as the supply fluid and a pressure source greater than that of the fluid being controlled must be available. The amount of control pressure is usually between 50-100 percent greater than the supply pressure. The output flow curves shown are for the Model 5 amplifier.





RATINGS

	Min.	Typical	Max.
VOLTAGE			
Supply voltage (D.C.)			8.0 V _{bc}
Supply voltage (surge, 1 sec)			12.0 V
Supply voltage (operating)	4.5	5.0	6.0 V
Input voltage			5.5 V
Output voltage			5.5 V
TEMPERATURE AND POWER			
Operating	-55		+125°C
Storage	-65		+200°C
Thermal gradient, junction to air (θ_{ja})			0.3°C/MW
Thermal gradient, junction to case (θ_{jc})			0.1°C/MW
Power Dissipation per gate (50% Duty Cycle, V _{cc} = +5v)		0	MW

ELECTRICAL CHARACTERISTICS

Characteristics @ $V_{CC} = +5.0V$		Values at Specified Temperatures			Units
		Symbol	-55°C	+25°C	
INPUT:					
Input Leakage Current @ V_{IN} Other Inputs I_B	$I_{IN\ LK}$	0.1 4.5 0 1.33	0.1 4.5 0 1.33	0.1 4.5 0 1.33	mA Max. Volts Volts mA
Inverse Beta Current @ V_{IN} Other Inputs I_B	$I_{IN\ B}$	0.1 4.5 Open 1.0	0.1 4.5 Open 1.0	0.1 4.5 Open 1.0	mA Max. Volts mA
Input Breakdown Voltage @ I_{IN} Other Inputs I_B	$BV_{IN\ I}$	5.5 1.0 0 1.33	5.5 1.0 0 1.33	5.5 1.0 0 1.33	Volts Min. mA Volts mA
Input Breakdown Voltage @ I_{IN} Other Inputs	$BV_{IN\ O}$	5.5 1.0 Open	5.5 1.0 Open	5.5 1.0 Open	Volts Min. mA
Base Emitter Drop @ I_B V_{IN} Other Inputs	$V_{B\ E}$	1.3 1.33 0 Open	1.1 1.33 0 Open	1.0 1.33 0 Open	Volts Max. mA Volts
OUTPUT:					
Collector Base Drop @ I_B All Inputs	$V_{B\ C}$	1.3 1.0 Open	1.1 1.0 Open	1.0 1.0 Open	Volts Max. mA
Offset Voltage @ I_B V_{IN} Other Inputs	V_{OS}	0.2 1.33 0 Open	0.2 1.33 0 Open	0.2 1.33 0 Open	Volts Max. mA Volts
Forward Beta @ I_B V_{IN} V_C Other Inputs	h_{FE}	3.0 1.33 0 1.5v Open	3.0 1.33 0 1.5 Open	3.0 1.33 0 1.5 Open	Min. mA Volts Volts

SWITCHING CHARACTERISTICS

Characteristics @ V _{cc} = +5.0V	Symbol	Values at Specified Temperatures			Units
		-55°C	+25°C	+125°C	
Δ Average Propagation Delay when added to SG120 series	Δtpd	3	3	3	nsec typ.
Δ Average Propagation Delay due to capacitance added at expansion terminals	Δtpd/pf	1.6	1.6	1.6	nsec typ.

** With circuit removed from carrier board; short leads

Fig. No.

1

2

1

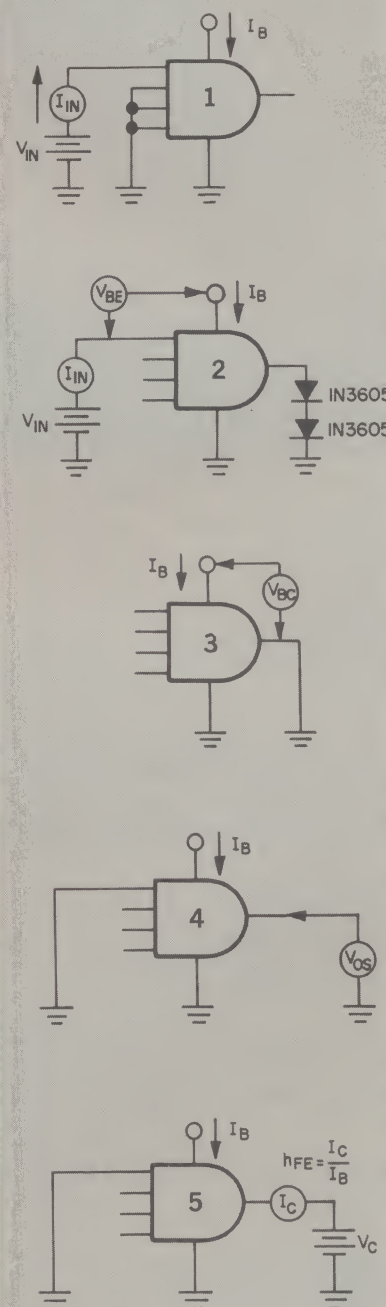
2

2

3

4

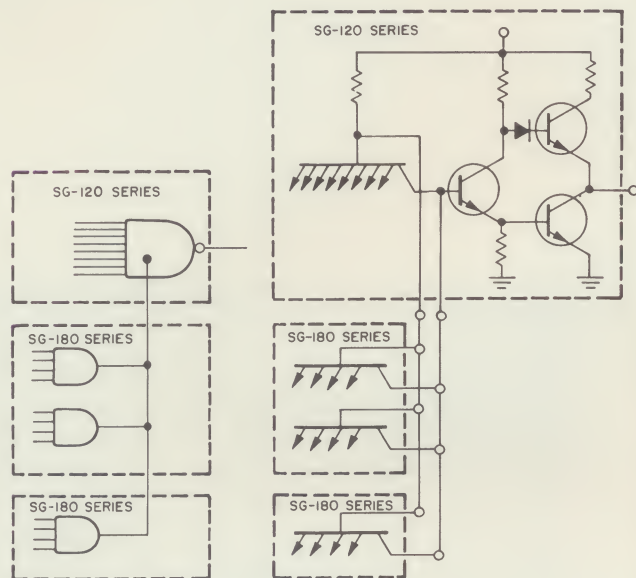
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APPLICATION 1.

Expanding the Fan In

For applications requiring high fan in, the SG180 series can be used to expand the fan in of the SG120 series to 20 as shown below.

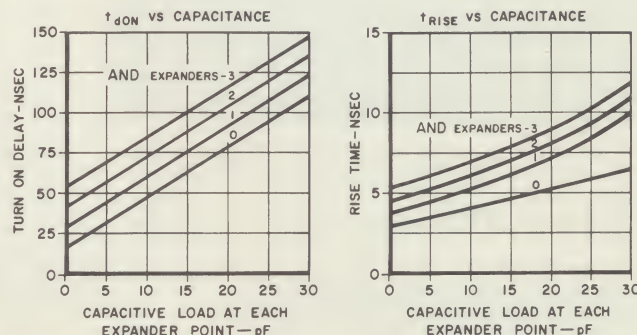


Note: Lead lengths to expander points should be kept as short as possible due to capacitive sensitivity of expander nodes. The increase in turn-on delay as a function of capacitive loading is approximately 1.6 nsec per picofarad.

APPLICATION 2.

Effect of Expansion and Capacitance on Switching

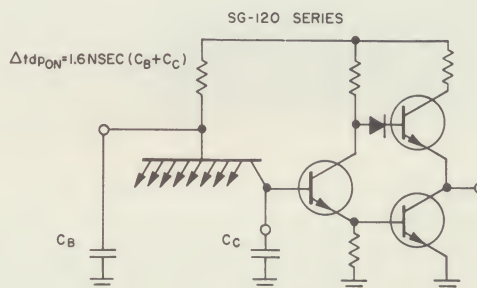
Conditions: $V_{CC} = +5.0V$, $F.O = 1$, $C_L = 15$ pf, unused Emitters + 3.0v.



An AND expander is $\frac{1}{2}$ of an SG180 series package (Removed from carrier board).

Curves showing effect of expanders and capacitance at the expansion points on turn on characteristics of the SG120 series; turn-off is unaffected by loading at these points.

For each pf of capacitance added at either expander point the t_{dON} increases approximately 1.6 nsec.



TYPICAL V_{IN} - V_{OUT} TRANSFER CHARACTERISTIC -55°C TO +125°C

For SG180/SG181 Connected to SG120 Series Gate

